

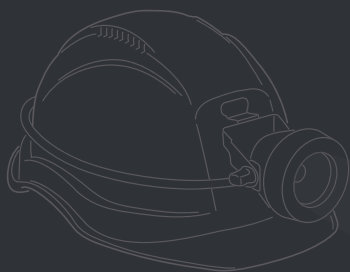
Wallarrah 2 Coal Project

Environmental Impact Statement

April 2013

Appendix Y

Agricultural Impact Statement



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Wallarrah 2 Coal Project Agricultural Impact Statement

Report prepared on behalf of Hansen Bailey Environmental Consultants for Wyong Areas Coal Joint Venture

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1 Introduction

1.1 Project Background

Scott Barnett & Associates Pty Limited (SBA) was commissioned by Hansen Bailey Environmental Consultants Pty Limited (Hansen Bailey) on behalf of Wyong Areas Coal Joint Venture (WACJV) to develop an Agricultural Impact Statement (AIS) to support an Application for State Significant Development Consent for the Wallarah 2 Coal Project (the Project) under Part 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.2 Project Description

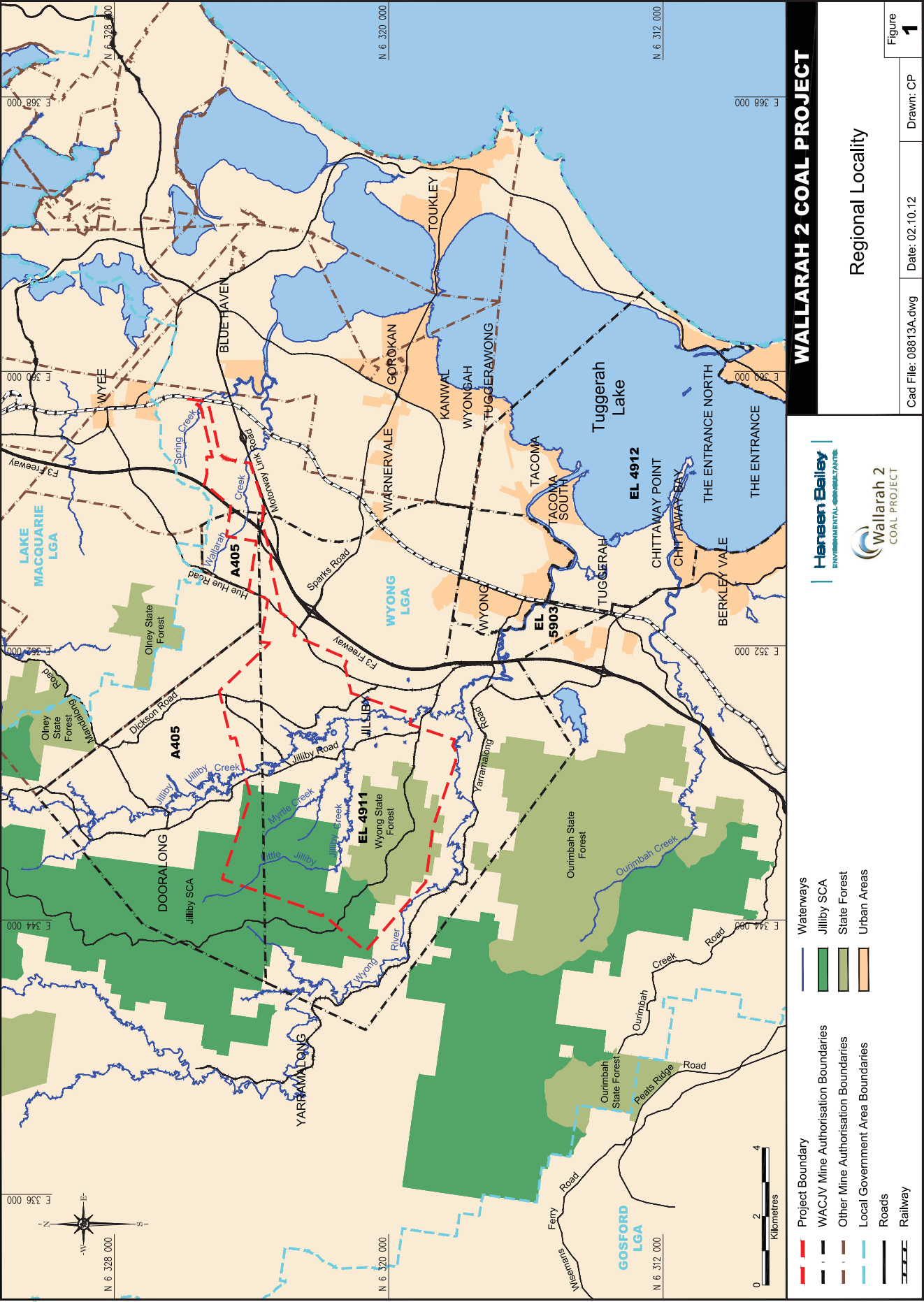
The WACJV seeks a Development Consent under Division 4.1 in Part 4 of the EP&A Act for the Project. This AIS supports 'The Wallarah 2 Coal Project Environmental Impact Statement' (Walarah 2 EIS) prepared by Hansen Bailey Environmental Consultants to support the application.

This AIS has been prepared in accordance with the Director-General's Environmental Assessment Requirements (DGRs) for the Project issued 12 January 2012 in accordance with the requirements in Part 2 in Schedule 2 to the *Environmental Planning & Assessment Regulation 2000* (EP&A Regs).

Development Consent is sought to mine coal within the Extraction Area for a period of 28 years. The majority of this resource lies beneath the Wyong State Forest and surrounding ranges (including the Jilliby State Conservation Area (SCA)) while a proportion, to be extracted first, lies beneath a section of the Dooralong Valley and the Hue Hue area. The location of the Project is shown on **Figure 1**.

Key features of the Project include:

- The construction and operation of an underground mining operation extracting up to 5.0 Mtpa of export quality thermal coal by longwall methods at a depth of between 350 m and 690 m below the surface within the underground Extraction Area;
- Mining and related activities will occur 24 hours a day 7 days a week for a Project period of 28 years;
- Tooheys Road Site surface facilities on company owned and third party land (subject to a mining lease) between the Motorway Link Road and the F3 Freeway which will include (at least) a rail loop and spur, stockpiles, water and gas management facilities, workshop and offices;
- Buttonderry Site Surface Facilities on company owned land at Hue Hue Road between Sparks Road and the Wyong Shire Council's (WSC) Buttonderry Waste Management Facility. This facility will include (at least) the main personnel access to the mine, main ventilation facilities, offices and employee amenities;
- An inclined tunnel (or "drift") constructed from the coal seam beneath the Buttonderry Site to the surface at the Tooheys Road Site;



- Construction and use of various mining related infrastructure including water management structures, water treatment plant (reverse osmosis or similar), generator, second air intake ventilation shaft, boreholes, communications, water discharge point, powerlines, and easements to facilitate connection to the WSC (after July 2013, the Central Coast Water Corporation) water supply and sewerage system;
- Capture of methane for treatment initially involving flaring as practicable for greenhouse emission management and ultimately for beneficial use of methane such as electricity generation at the Tooheys Road Site;
- Transport of coal by rail to either the Newcastle port for export or to domestic power stations;
- A workforce of approximately 300 full-time company employees (plus an additional 30 contractors); and
- Rehabilitation and closure of the site at cessation of mining operations.

1.3 Assessment Objectives

The purpose of the AIS includes:

- Addressing the DGRs relating to agriculture, issued on 12 January 2012 (**Table 1**);
- Addressing relevant policies and plans relating to agriculture;
- Describing the agricultural resources and enterprises in the general locality, including identifying any State significant agricultural resources;
- Identifying the agricultural potential domains of the land within the Project Boundary;
- Assessing the current and maximum agricultural potential for each domain in terms of quantum, gross and net value of agricultural production;
- Assessing the loss of agricultural production from within the Project Boundary during the life of the Project in terms of value of agricultural production and downstream activities within the value chain and support activities;
- Assessing the potential loss of agricultural activities from within the Offsite Biodiversity Offset Area in terms of value of agricultural production and downstream activities within the value chain and support activities;
- Assessing the use of the regulated water supply for the Project in comparison to it being used for agricultural purposes within the regulated system;
- Assessing the potential impacts on the agricultural resources and enterprises within the Project Boundary; and
- Providing appropriate mitigation and management measures.

1.4 Exclusion from Report

This report does not include a discussion or assessment of the impact of the Project on the Forest resources within the Project area. This is covered by the Forestry Assessment Impact Statement within the main EIS (GHD 2012).

1.5 Study Area

The study area for the AIS comprises:

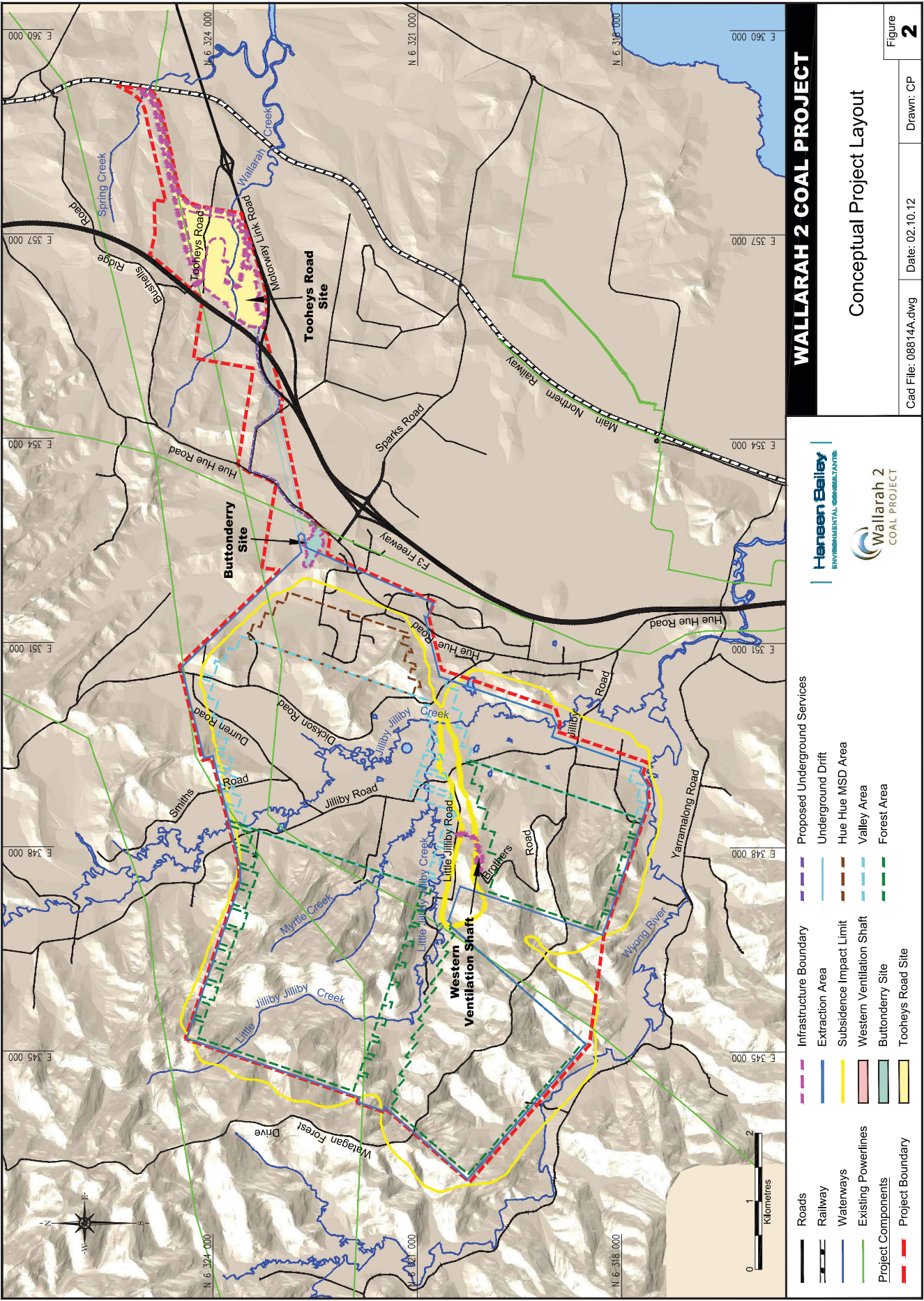
- The Project Boundary (approximately 4,559 ha) including:
 - Infrastructure Boundary (approximately 165 ha made up of Tooheys Road Site 152 ha, Buttonderry Site 10 ha and Western Ventilation Shaft 3 ha of which approximately 93 ha is proposed to be disturbed);
 - Land within the Project Boundary (approximately 4,260 ha) that will not be disturbed of which the current agricultural land has the potential to remain available for agricultural production; and
 - Land within the Project Boundary that will be used for Biodiversity offsets (approximately 206 ha).
- Land outside but adjacent to the Project Boundary that will be used for Biodiversity offsets (approximately 66 ha of which approximately 21 ha is currently used for agriculture) referred to as the Offsite Biodiversity Offset Area; and
- The general locality (defined as the land within a 2km radius of Project Boundary).

These areas are shown in **Figure 2**.

1.6 Related Studies

The studies which are to be read in conjunction with this assessment include the following:

- The EIS soil and land capability impact assessment;
- The EIS ecology impact assessment;
- The EIS surface water impact assessment;
- The EIS flood impact assessment;
- The EIS air quality impact assessment;
- The EIS acoustic impact assessment;
- The EIS visual impact assessment;
- The EIS traffic and transport impact assessment;
- The EIS subsidence assessment;
- The EIS social impact assessment; and
- The EIS economic impact assessment.



2 Regulatory Framework

This chapter describes the regulatory framework relevant to the Project and this AIS.

2.1 Environmental Planning and Assessment Act 1979

The EP&A Act is the overarching planning legislation in NSW. This act provides for the creation of planning instruments that guide land use.

WACJV seeks a Development Consent under Division 4.1 in Part 4 of the EP&A Act for the Project. This AIS supports Wallarah 2 EIS prepared by Hansen Bailey Environmental Consultants to support the application.

This AIS has been prepared in accordance with the DGRs for the Project issued 12 January 2012 in accordance with the requirements in Part 2 in Schedule 2 to the EP&A Regs. **Table 1** lists the DGRs relevant to this assessment and the sections in this report where these DGRs are addressed.

Table 1 Director General's Environmental Assessment Requirements

Requirement	Report Section Where Addressed
<p>The EIS must include a detailed assessment of the key issues specified below, and any other significant issues identified in this risk assessment, which includes:</p> <ul style="list-style-type: none"> ○ a description of the existing environment, using sufficient baseline data; ○ an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes; and ○ a description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the development, including proposals for adaptive management and/or contingency plans to manage any significant risks to the environment. 	Section 9
<p>Land Resources - including a detailed assessment of the potential impacts on:</p> <ul style="list-style-type: none"> ○ agricultural resources and/or enterprises in the local area, including: <ul style="list-style-type: none"> – any change in land-use arising from requirements for biodiversity offsets; – a detailed description of the measures that would be implemented to avoid and/or minimise the potential impacts of the project on agricultural resources and/or enterprises; and – justification for any significant long term changes to agricultural resources, particularly if highly productive agricultural resources (e.g. alluvial lands) are proposed to be affected by the project. 	Sections 5, 8 and 9
The proposed assessment of agricultural impacts as per the Draft Guideline for Agricultural Impact Statements is supported.	Section 2.2

2.2 Guideline for Agricultural Impact Statements

The Guidelines for AIS released by DP&I in March 2012 outlines the requirements for the assessment of agricultural impacts associated with all State significant development applications, particularly coal mining and petroleum proposals. **Table 2** outlines the guidelines for AIS requirements and identifies where it has been addressed in the report.

Table 2 Guidelines for Agricultural Impact Statements Requirements

Guideline Requirement	Report Section Where Addressed
Detailed assessment of the agricultural resources and agricultural production of the project area	Section 4 and 5
Identification of the agricultural resources and current agricultural enterprises within the surrounding locality of the project area	Section 4
Identification and assessment of the impacts of the project on agricultural resources or industries	Section 8
Account for any physical movement of water away from agriculture	Section 8.2.3
Assessment of socio-economic impacts	Section 5.3
Identification of options for minimising adverse impacts on agricultural resources, including agricultural lands, enterprises and infrastructure at the local and regional level	Section 9
Document consultation with adjoining land users and government departments	Section 6

2.3 Water Management Act 2000

The objective of the Water Management Act 2000 (WM Act) is the sustainable and integrated management of the State's water for the benefit of both present and future generations. The WM Act provides clear arrangements for controlling land based activities that affect the quality and quantity of the State's water resources.

Within the locality there are two water resources which are subject to the WM Act. These are:

- The Jilliby Jilliby Creek Water Source which flows through the Extraction Area; and
- Wyong River (previously known as Wyong Creek) which lies to the south of the extraction area and is part of the Central Coast unregulated and alluvial water sources.

The various water sources are shown on **Figure 2**.

Each of these water sources operate under separate Water Sharing Plans. These plans are legal documents made under the WM Act. The plans contain the rules for how water is shared between the environment and water uses and different categories of licences. They also document the rules how water entitlements and allocations can be traded between water users within the water source and, where applicable, between water sources.

The Water Sharing Plan for the Jilliby Jilliby Creek Water Source (NSW Department of Infrastructure, Planning and Natural Resources, 2005) commenced on the 1 July 2004 and applies for a period of 10 years to 30 June 2014. It was revised in 2009 following consultation associated with a formal 5-year review of the WSP.

The Water Sharing Plan Central Coast unregulated and alluvial water sources commenced in the 1 August 2009 and applies for a period of 10 years (NSW Department of Water and Energy, 2009).

The Project is situated in an area where a potential source of water is any of the above water sources and therefore any water extraction for the Project is subject to the provisions of the WM Act and the relative Water Sharing Plan.

2.4 Wyong Shire Local Environmental Plan

The Wyong Shire Local Environmental Plan (LEP) (1991) outlines what development is allowed in each zoning and special provisions. The plan includes definitions to provide a greater understanding of what uses and building types are permitted, and also include planning controls that may apply to a particular site, such as properties that have a heritage listing.

Planning Reforms implemented by the NSW State Government require each council in NSW to prepare a new LEP, which is consistent with a Standard Instrument. It's proposed that the draft LEP will be placed on public exhibition in 2012 and anticipated that it will be adopted by either late 2012 or early 2013.

3 Existing Environment

This chapter describes the existing environment of the study area for the AIS.

3.1 Climate

The climate of the area is warm temperate with a maritime influence (Murphy, 1993). The Bureau of Meteorology (BOM) (2012) records for Gosford (Narara Research Station, AWS 061 087) indicate that the mean maximum temperature over summer ranges between 26.8oC and 27.6oC. In winter the mean minimum temperature ranges between 4.7oC and 6.5oC.

Average daily solar radiation peaks at 23.3 MJ/m² in December and is lowest in June at 9.3 MJ/m².

Rainfall in the area averages 1,325.4 mm per annum with the median rainfall being 1,253.4 mm. Rainfall shows a dominance in summer and autumn with average monthly rainfall from November to June varying from 92.0 mm to 153.2 mm (median rainfall 80.2 mm to 132.2 mm), whilst in winter average monthly rainfall levels range between 80.7 mm and 68.8 mm (median 50.0 mm and 62.5 mm).

Evapotranspiration rates computed using the monthly mean daily evaporation figures for BOM weather station at Peats Ridge (AWS 061 351) indicate that soil moisture availability remains high throughout the year. This observation is supported by Edwards (1979) as quoted by Murphy (1993).

The climate is able to support year round growing season with temperate species (pastures and crops) being suited the cooler months and sub tropical species being adapted to the warmer months.

3.2 Topography

The predominate topography is the steep valleys and hills associated with the western portion of the Project Boundary. These areas fall within the Jilliby State Conservation Area and the Wyong State Forest. Slopes are greater than 20% and local relief is up to 220 m.

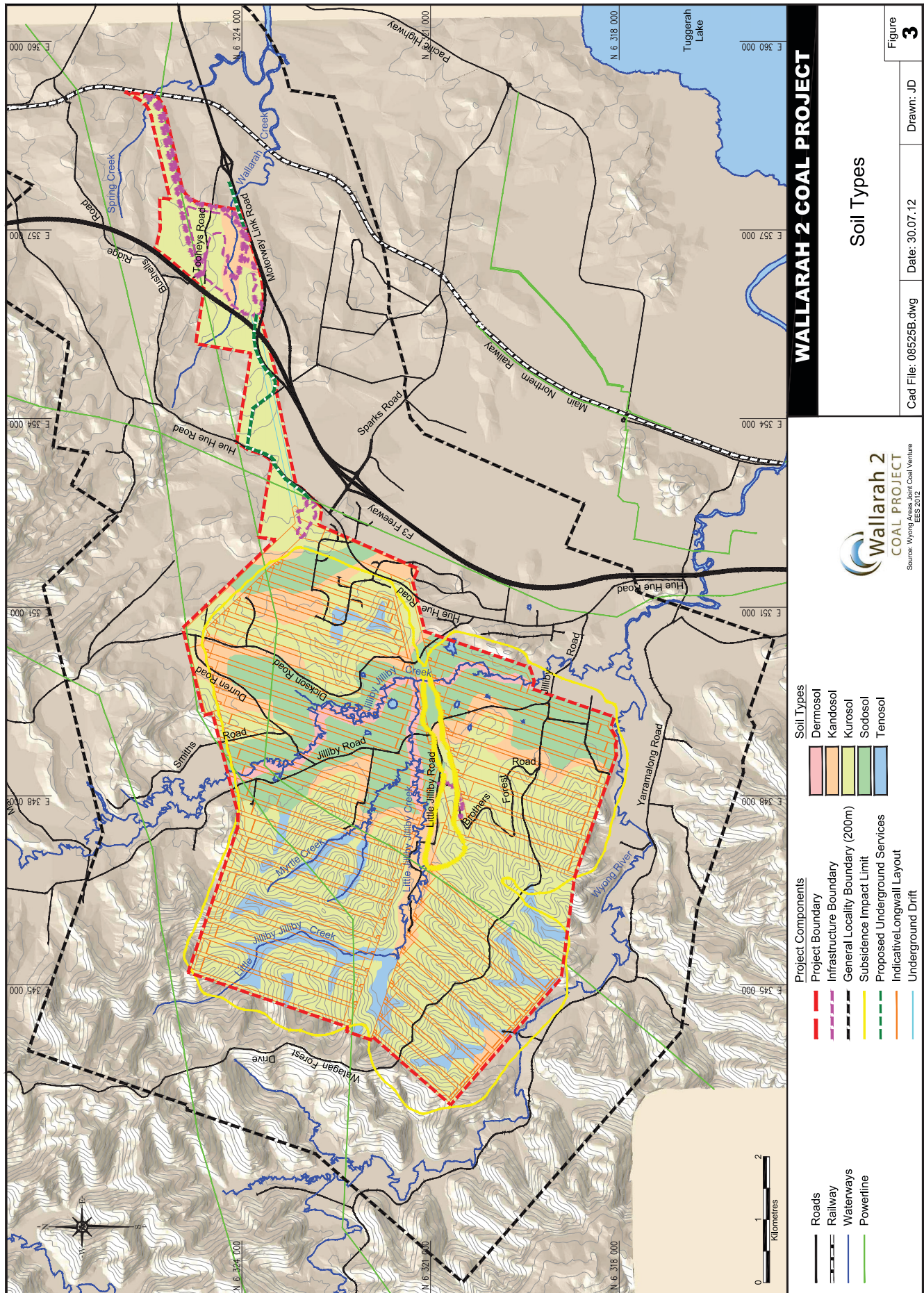
The topography then transforms to rolling hills and to the limited creek flats associated with the Jilliby Jilliby Creek and the Little Jilliby Creek. These have low slopes of less than 3% and local relief of less than 15 m. Meander scrolls, oxbows and swamps are common.

The northern portion of the Project Boundary is undulating low hills and rises with slope gradients usually less than 15% and local relief of less than 30 m. This includes the infrastructure areas Tooheys Road Site and Buttonderry Site.

Drainage is generally from the west to the east, draining into Tuggerah Lake to the east of the Project Boundary.

3.3 Soils

Environmental Earth Sciences (EES) (2012) prepared a soil and land capability impact assessment of Project Boundary (EES, 2012). The impact assessment indicates that the primary agricultural soils are Dermosols, Sodosols and Kandosols. These are shown in **Figure 3**.



The Dermosols are the alluvial soils associated with the creek flats of the Jilliby Jilliby Creek and lower reaches of the Little Jilliby Creek. These soils are deep alluvials and siliceous sands of the Yarramalong soil landscape. Murphy (1993) describes the fertility of these soils as:

“Soil materials are strongly acid, are sodic, have low nutrient status, low CECs and low to moderate available water holding capacity. A soil volume for root penetration is high. General soil fertility is low to moderate.”

The Sodosols are alluvial soils associated with the Yarramalong and Wyong soil landscapes and are also associated with the alluvial creek flats away from the main channel. Of similar low fertility, these soils of the Wyong soil landscapes have higher water holding capacity and are subject to seasonal waterlogging. Where the water table is high, root penetration may become limited. The general fertility is low.

The Kandosols are located adjacent to the alluvial landscapes on the lower slopes of the hills and ranges running away from the flats. These soils correspond with the residual Woodburys Bridge soil landscape and erosional Erina and Gorokan soil landscapes (EES 2012). These soils are again generally low in fertility and CEC capacity, have low pH, have low water holding capacity and on higher rises have a low root penetration depth. The fertility status is low to moderate.

3.4 Agricultural history of the locality

European settlement commenced around 1825 when William Cape was granted land in the Wyong area including land at Jilliby. Traditional land uses were timber getting and grazing. The construction of the railway (Sydney to Newcastle) in the late 1880's saw the expansion of the timber and agricultural industries. The 1890's saw the expansion of citrus and dairying in the region.

The traditional agricultural land use of the alluvial land and near hills has been dairying and beef grazing. Associated cropping (maize, cereal crops and forage crops) was also carried out. In 1906 the Wyong Dairy Company was established with the butter factory being built in 1907. The site is situated on Wyong River immediately adjacent to the eastern side of the F3 expressway. The Wyong milk factory continued operation until the mid 1990's when it was closed with the few remaining dairy farms on the central coast having their milk sent to Sydney for processing.

Historically the other major agricultural industries of the central coast area have been citrus production, vegetable production and poultry rearing. These have tended to be more on the plateau to the west of the coastal plain.

A more recent development has been the commencement of turf farming on some of the traditional dairy flats of the Yarramalong Valley and Dooralong (Jilliby Jilliby Creek) Valley.

Urban encroachment and the advent of rural residential land and Hobby farms have seen the expansion of small scale beef grazing and horse related activities on the valley floor and nearby lower slope lands. Horse activities include breeding, education and agistment/spelling. This includes thoroughbred, performance and pleasure horses. Pleasure horse agistment and riding facilities servicing the urban areas of the Central Coast are evident in the Dooralong Valley.

3.5 Unregulated Water Sources

The Jilliby Jilliby Creek and its tributaries, Little Jilliby Creek and Myrtle Creek, flow through the Extraction Area. It is a major tributary of Wyong River. Wyong River flows to the south of the Extraction Area and outside the Project Boundary. These water sources drain to Tuggerah Lake to the east of the Project Boundary.

3.5.1 Jilliby Jilliby Creek Water Source

A water sharing plan for Jilliby Jilliby Creek under the WM Act commenced 1 July 2004 and applies to 30 June 2014. There is a range of different water access licences. These are:

- Local water utility –(town water);
- Domestic and stock;
- Unregulated river – (irrigation, industry, mining, recreation and general farming); and
- Aboriginal cultural.

At the start of the plan there were 27 water access licences in the water source. Of these, 23 were for irrigation, 1 for farming purposes, 1 for industrial and 2 for domestic and stock purposes (DIPNR 2005). There were no Local Water Utility or Aboriginal Cultural licences. The requirements for all categories of licences from the water source totalled approximately 1,016 ML (based on 1 share component equalling 1 ML). In addition to the water access licences the Basic Landholder Right (for properties that directly front the river) is estimated at 0.51ML per day.

Jilliby Jilliby Creek has a natural variable flow from frequent flood to drought. Annually, December tends to be period of lowest flow. This corresponds with a period of usually high irrigation demand.

Jilliby Jilliby Creek is classed as a stressed river (potential extraction is high compared to natural flows). The Water Sharing Plan sets a limit on overall extraction on an annual basis (long term average extraction) and also daily extraction (total daily extraction). Water available for unregulated river licences is made available after allowance for Basic Landholder Right, environmental flows, Aboriginal culture, Local utility and Domestic and Stock are made.

3.5.2 Wyong River Water Source

Wyong River falls under the Water Sharing Plan for the Central Coast unregulated and alluvial water sources (CCWSP). It is noted that Jilliby Jilliby Creek is not covered by this water sharing plan as it has its own water sharing plan (cf Section 3.5.1). The CCWPS commenced on 1 August 2009 and applies for a period of 10 years (NSW DWE 2009). There is a range of different water access licences. These are:

- Local water utility –(town water);
- Domestic and stock;
- Unregulated river – (irrigation, industry, mining, recreation and general farming); and
- Aboriginal cultural.

The CCWSP identifies two Extraction Management Units (EMU), of which the Wyong River is an individual water source within the Tuggerah Lakes EMU.

The Wyong River Water Source has a total surface water entitlement of 38,782 ML per year of which 10% is used for irrigation and 89% is used for town water supply purposes (NSW DWE 2009a). There are 94 surface water licences which have a daily extraction limit of 79.9ML/day. This represents 78.6% of the Tuggerah Lake EMU entitlement.

There are no Aboriginal cultural water licences.

3.6 Local Environmental Plan Land Zonings

The Wyong Shire Local Environmental Plan (1991) sets out land zoning for the Project Boundary. Zoning for the Project Boundary is shown in **Figure 4**. This shows:

- Tooheys Road Site is Zone 4 (Industrial)
- Buttonderry Site is Zone 1c (Non Urban Constrained Lands)
- Extraction Area is a mixture of Zone 1a (Rural), Zone 1f (Forestry), Zone 7a (Conservation), and Zone 7b (Scenic Preservation) with small areas of Zone 6a (Open Space & Recreation) and 6b (Regional Open Space and Recreation).

The Rural Zone 1a is associated with the creek flats of the Jilliby Jilliby Creek and Little Jilliby Creek and close-by lower slopes.

4 Existing Agricultural Enterprises and Resources

This chapter identifies and describes the existing agricultural resources and enterprises within Project Boundary and the surrounding locality.

4.1 Agricultural Enterprises

Agricultural enterprises within the locality including the Extraction Area were determined by personal observation and examination of aerial images (Google Maps™). The area has undergone major changes in land use over the last 20 to 30 years which has seen larger holdings being fragmented and converted to rural lifestyle blocks. The predominant land uses of the valley floor and near slopes are small scale beef grazing, horse enterprises and lifestyle blocks. The beef grazing enterprises are predominantly low input, low intensity management operations with many being sub commercial in scale.

Land to the east of the Project Boundary (east of F3 Freeway) is used for industrial and residential purposes.

Turf farming is carried out on the creek flats of the Jilliby Creek and Wyong River. There is one turf farm located in the Extraction Impact Area (see **Figure 4**). This operates on the Jilliby Creek flats, straddling both sides of the watercourse. Just outside the Extraction Area on the south east corner is another turf farm operating on either side of the Wyong River. Other turf farms operate further up the Wyong River (and south of the Project Boundary) and further south of the Wyong River along the Old Maitland Road.

Other rural land uses in the Yarramalong Valley (outside the Project Boundary) are:

- Pleasure and performance horse keeping;
- Racing stables;
- Horse studs (thoroughbred, performance and pleasure horses);
- Spelling and agistment (thoroughbred, standardbred, performance and pleasure horses);
- Small scale extensive beef grazing, primarily breeding enterprises with some registered breeders; and
- Small scale horticultural enterprises (nut farm, lavender grove).

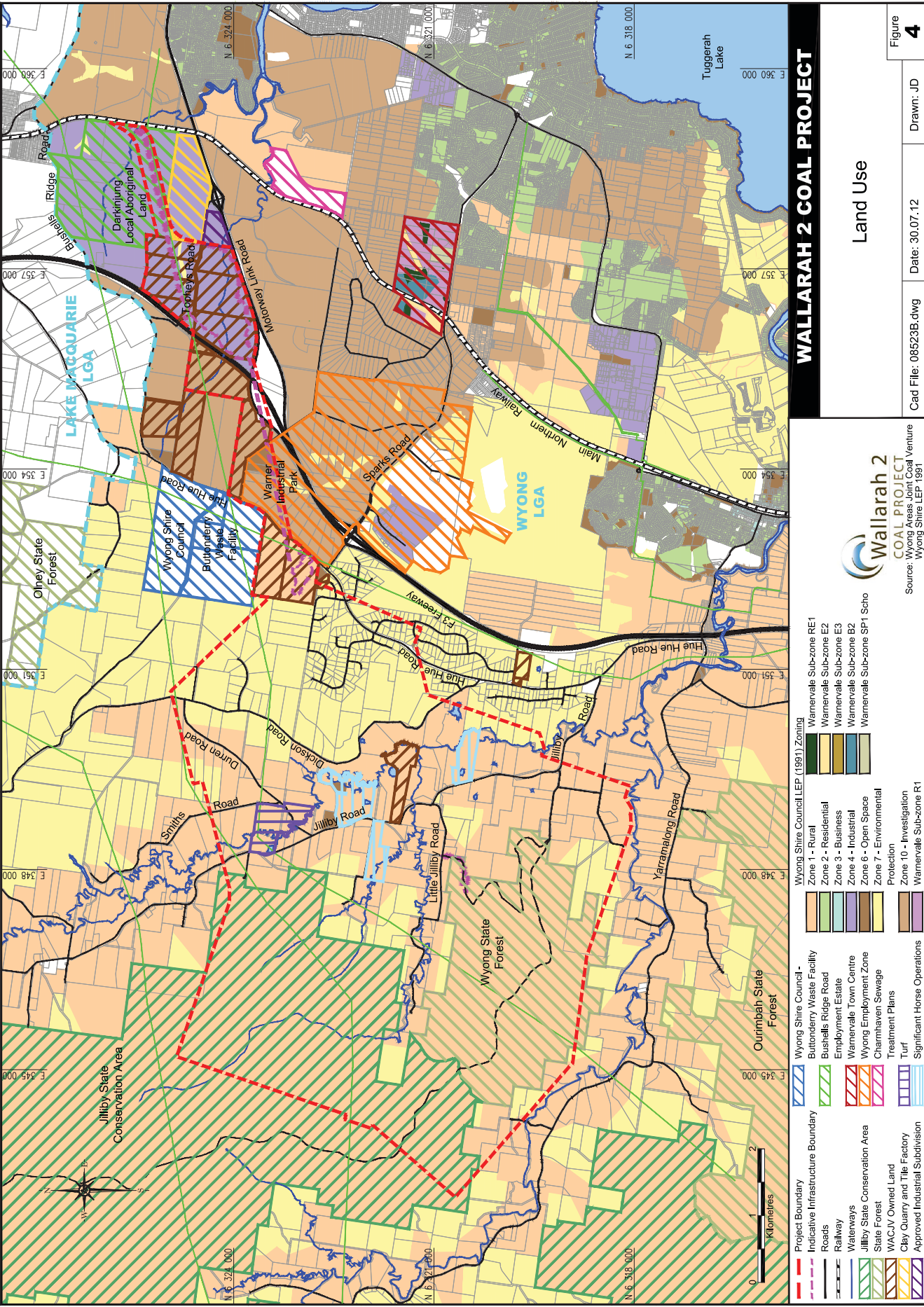
Both the Tooheys Road Site and the Buttonderry Site are used for grazing but in a very undeveloped fashion. The Tooheys Road Site is Zone 4e Regional Industrial and Employment Development while the Buttonderry Site is Zone 1c Non Urban Constrained Lands.

Within the Extraction Area, land to the east of Dickson Road is predominately rural residential with limited grazing areas and areas of semi cleared timber and or regrowth. This area is Zone 7 (Environmental Protection) under the Wyong Shire LEP. Grazing land within the Extraction Area is used primarily for beef grazing or horse activities. Beef enterprises consist of either breeding for vealer production or growing out of early weaned steers for local trade.

Horse activities are similar to those of the Yarramalong Valley. There are a couple of larger agistment and pleasure horse facilities near the village of Jilliby (see **Figure 4**).

The land proposed to be used for Offsite Biodiversity Offset is Zone 10 (Investigation). Thus land is either covered with dense timber or cleared for low intensity grazing of beef cattle.

The location of these agricultural enterprises and Wyong LEP land zoning as well as surrounding land use is demonstrated on **Figure 4**.



4.2 Supporting Infrastructure and Services

Agricultural enterprises in the locality of the Project Boundary are supported by a range of general agricultural services.

Cattle production in the locality relies on the livestock sale yards at Maitland. These sale yards hold weekly fat sales and monthly store sales, which are serviced by livestock agents from Maitland and Dungog in the Hunter Valley.

Agricultural industries in the locality rely on a range of services provided in the Wyong and Gosford Local Government Areas (LGA), including veterinary practices, input suppliers (fertiliser, seed, chemicals, and agricultural hardware), irrigation suppliers and technicians, and heavy and light engineering works. These are supplemented by agricultural input suppliers in the Maitland and Cessnock LGAs.

Local carriers supply transport services for livestock and general cartage.

The key route utilised by most agricultural enterprises is the F3 Freeway.

4.3 Agricultural Resources

The significant agricultural resources in the locality of the Project include:

- Jiliby Jiliby Creek Water Source; and
- Wyong River Water Source.

4.4 Agricultural Value

The agricultural industry for the local coastal region (LCR) includes the Gosford, Wyong and Lake Macquarie Local Government Areas (LGAs). ABS 2006 Agricultural Census data (ABS 2008) shows the Gross Value of Agricultural Production (excluding equine) from the three LGAs of the Central Coast was \$154.7 M of which \$34.1 M was generated in the Wyong LGA. **Table 3** shows the Gross Value of Agricultural production and the major agricultural enterprises from within the Project Area for Wyong LGA comparatively to the Central Coast and NSW.

Table 3 Gross Value of Agricultural Production

Category	Wyong LGA	LCR*	NSW
Turf production	\$3.983 M	\$4.350 M	\$ 58.754 M
Turf production establishments (no.)	11	N/A	N/A
Beef Slaughterings \$ M	\$ 0.525 M	\$1.112 M	\$1,603.272 M
Beef establishments (no.)	60	151	29,675
Gross Value of Agricultural Production	\$34.076 M	\$154.700 M	\$9,034.542 M
Total agricultural establishments (no.)	160	475	48,838

* Wyong, Gosford and Lake Macquarie LGAs combined

Source: ABS 2008

The above table shows that for the two main agricultural industries within the locality of the Project Boundary, the gross value of production from across the Wyong LGA and the LCR represents 13.2% and 3.5% of the total agricultural production of the respective areas.

4.5 Employment

The agricultural industry in the Wyong LGA employs 433 people (ABS 2006) and 1,150 in the LCR. This represents 0.3% of the workforce of the Wyong LGA and 0.7% of the three LGAs. Employment break up is shown in **Table 4**.

Table 4 Central Coast Agricultural* Industry Employment

Occupation	Wyong LGA	LCR
Managers	154	502
Professionals	10	30
Technicians & trade	73	150
Clerical & administration	28	62
Sales	9	21
Machinery operators & drivers	10	30
Labourers	142	341
Other	7	14
Total agriculture*	433	1,150
Total workforce	53,861	150,928

* Includes Agriculture, forestry and fishing

Source: ABS (2007)

5 Agricultural Impact Assessment

This chapter discusses the agricultural assessment of the land within the Project Boundary. It also provides alternative land uses for the agricultural land within the Project Boundary.

5.1 Methodology

The assessment methodology comprised:

- A review of the EIS soil and land capability impact assessment prepared by EES (2012);
- A review of the EIS surface water impact assessment by WRM Water and Environment (WRM)(2012);
- A review of the EIS subsidence impact assessment by Mine Subsidence Engineering Consultants (MSEC)(2012);
- A review of the EIS ground water impact statement by Mackie Environmental Research (2012);
- A review of the EIS ecology impact assessment by Cumberland Ecology (2012);
- An initial site visit with the WACJV Project Environment and Community Manager to site to become familiar with the Project Boundary and locality;
- A review of Land Zonings as within Project Boundary as per Wyong Shire LEP (1991);
- A number of site visits to Project locality to assist in reviewing EES's soil and land capability impact assessment and to inspect the current agricultural production at the Project and in the locality;
- Desktop analysis of the value of agricultural production from Project Boundary and enterprises in the locality; and
- Desktop analysis of the agricultural production's contribution to the local, regional, State and national agricultural output.

5.2 Agricultural Domains

The Project was dissected into agricultural domains based on the soil and land capability impact assessment (EES, 2012) and Scott Barnett Associates' (SBA) own observations. The domains are shown in **Figure 5**.

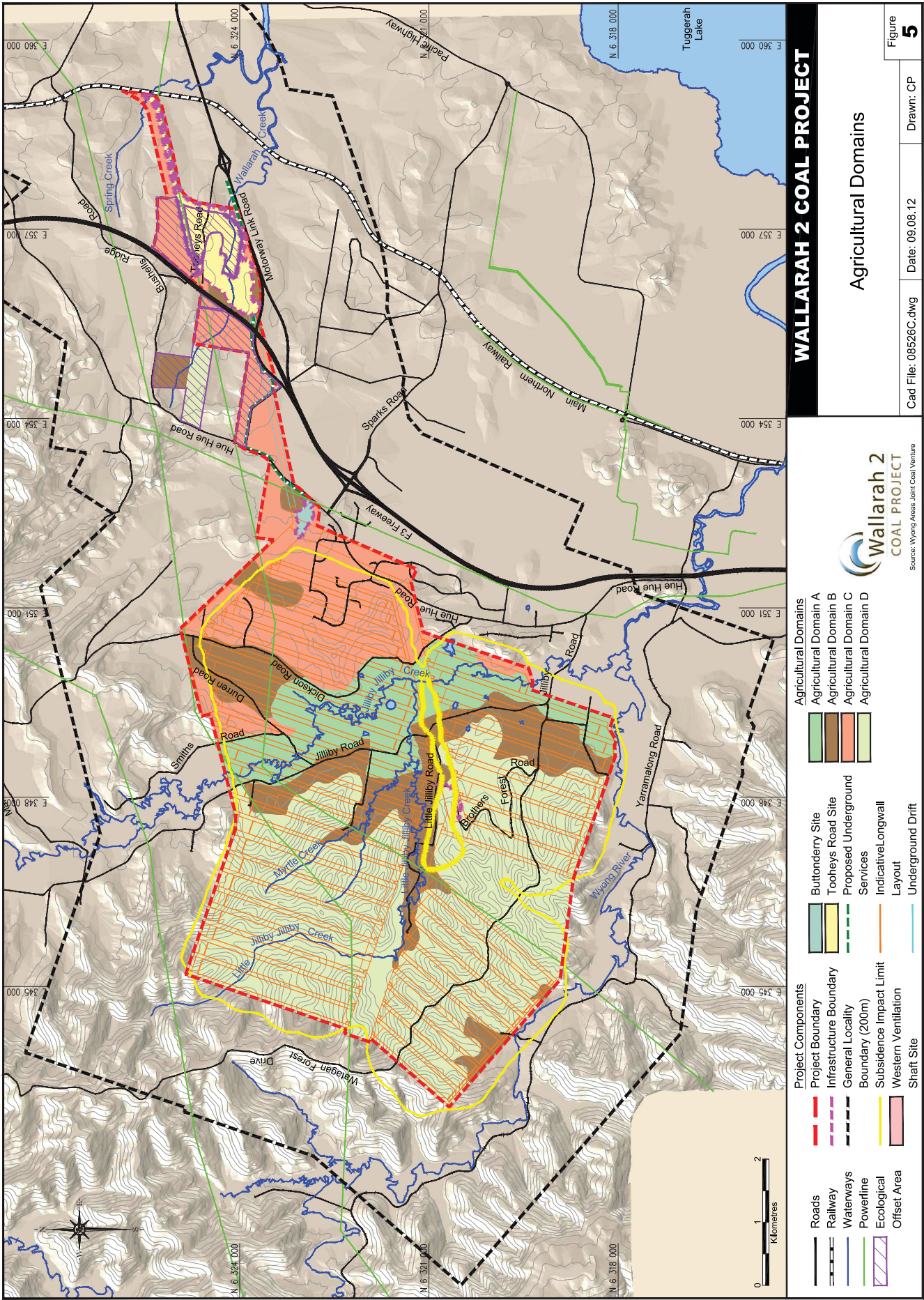


Table 5 provides an overview of each of the agricultural domains and their quantitative distribution within the Project Boundary.

Table 5 Project Boundary Agricultural Domains

Agricultural Domain	Description	Area (ha)	Area %
A	Area associated with the creek flats of Jilliby Jilliby Creek and tributaries, suited to grazing (naturalised and improved pastures) and fodder cropping with better areas able to be cropped for turf farming. Some areas are irrigated with others irrigated in the past.	572	12.5
B	Area associated with lower slopes to mid slopes of Jilliby Jilliby Creek and tributaries, upper reaches of tributaries and cleared areas associated with Tooheys Road Site and Buttonderry site. Land suited to grazing as naturalised and improved pastures. Cultural techniques restricted to minimal to occasional soil disturbance. Also includes small areas within Project Boundary within Yarramalong Valley.	826	18.1
C	Area associated with lower to mid slopes east of Jilliby Creek and running to the north east to the Tooheys Road site. Area has extensive areas of timber (regrowth) and partially cleared land. Land mainly Zone 7 Environmental Protection under Wyong Shire LEP. Poor quality pasture and limited grazing activities.	1,032	22.6
D	Land to west of Jilliby Jilliby Creek flats and slopes consisting of steeper slopes. Heavily timbered, non-cleared land. Main areas form part of Wyong State Forest and Jilliby State Conservation Area and timbered areas running to cleared lower slopes.	2,129	46.7
Total		4,559	100.0

Table 5 shows that the majority (2,129 ha or 46.7%) of the Project Boundary is land classified as Agricultural Domain D. This land is not suited to agriculture. This land primarily coincides with the following from the EIS soil and land capability impact assessment (EES, 2012):

- Soil type Kurosol and small areas of Tenosol;
- Land capability class VII; and
- Agricultural land suitability class 5.

Agricultural Domain A is the highest quality agricultural land and least abundant in the vicinity of the Project, comprising an area of approximately 572 ha (12.5%). This land is suited to fodder cropping and/or cultivation to establish improved pasture. It is not suited to continuous (annual) cultivation due to the underlying soil type and susceptibility to erosion. Limited areas have been levelled and used for turf farming. This land primarily coincides with the following from the EIS soil and land capability impact assessment (EES, 2012):

- Soil types Dermosol and Sodosol;
- Land capability class III; and
- Agricultural land suitability class 3.

Agricultural Domain B covers an area of 826 ha (18.1%) and is suited to occasional cultivation for fodder cropping and pasture establishment. This land is capable of supporting reasonable levels of pasture production and as such can be used for beef cattle grazing for raising vealers. This land primarily coincides with the following from the EIS soil and land capability impact assessment (EES, 2012):

- Soil types Sodosol and Kandosol;
- Land capability classes III and VI; and
- Agricultural land suitability class 3 and 4.

Agricultural Domain C covers an area of 1,032 ha (22.6%) and is suited to limited and occasional grazing by beef breeders to produce weaner cattle (unfinished). The agricultural value of this land is limited by its slope, preventing or limiting the level of pasture improvement requiring careful management to avoid overgrazing and or the extent of rural residential development. The land is not suitable to be cleared for further pasture development as it would fall under the Native Vegetation Act (2003) (NV Act). This land primarily coincides with the following from the EIS soil and land capability impact assessment:

- Soil types Kurosol, Kandosol and small areas of Tenosol;
- Land capability classes VI and VII; and
- Agricultural land suitability classes 4 and 5 with small areas of class 3.

Similarly the Offsite Biodiversity Offset Area was also divided into agricultural domains as per the same criteria. These are also shown in **Figure 5**.

Table 6 provides an overview of each of the agricultural domains and their quantitative distribution within the Offsite Biodiversity Offset Area.

Table 6 Offsite Biodiversity Offset Area Agricultural Domains

Agricultural Domain	Description	Area (ha)	Area %
B	Cleared area with naturalised and native pasture.	21	31.8
D	No cleared area.	45	68.2
Total		66	100.0

Agricultural Domain B covers approximately 21 ha or 31.8% of the Offsite Biodiversity Offset Area. It is suitable grazing by beef cattle for a breeding enterprise.

Agricultural Domain D is not able to be used for agriculture as it is unable to be cleared as per the NV Act. It represents 68.2% (approximately 45 ha) of the Offsite Biodiversity Offset Area.

5.3 Agricultural Production and Value

5.3.1 Project Boundary

To examine the quantum and value of the agricultural production from Project Boundary, information as to the current agricultural practices was obtained from discussion with officers of NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) (Primary Industries) and the Hunter Central Rivers CMA. This was supported by personal observation by the author during a number of visits to the locality during the study period.

The predominant enterprises identified were:

- Turf farming;
- Beef cattle grazing (primarily breeding); and
- Equine activities: Breeding, training and education, spelling and agistment,

To calculate the quantum and value of agricultural production from the Project Boundary this information was used in association with:

- DTIRIS (Primary Industries) (2011) beef cattle gross margin budgets; and
- An economic analysis of the Australian turf industry commissioned by Horticulture Australia Limited (Aldous et. al. 2007).

The quantum of land allocated to each enterprise in each Domain is as follows:

- Turf 28 ha in Domain A;
- Beef 80% non turf area in Domains A and B, all of Domain C; and
- Horse activities 20% of grazing area in Domains A and B.

The value of the horse activities on the agricultural land within the Project Boundary is more difficult to ascertain. The gross value of agricultural production from the land occupied was examined by two methods: estimating the percentage area used for horse activities and prescribed horse agistment income based on horse carrying capacity of the land; and economic survey carried out by the author in 2011 in the Upper Hunter of thoroughbred broodmare agistment charges and costs (Scott Barnett & Associates, 2011, Unpublished data). The base assumption is that the grazing pressure of a 500kg horse is the equivalent that of a 500 kg cow due the more selective grazing nature of a horse and therefore a lower percentage of pasture utilisation (Allen et. al 2007). Brood mare agistment was used as it is assumed that this would not underestimate the value of horse-related activities on the agricultural land within the Project Boundary.

All assumptions used to calculate the agricultural production and value are outlined in Appendix 1. Turf Production assumptions are based on Arduous et. al.(2007). Within this study the turf production figures were based on a medium size farm (26 - 50 ha) and varieties were 60% buffalo, 20% kikuyu and 20% couch (buffalo being the highest priced turf per m² - \$7.04 compared with \$3.25 for kikuyu and \$4.26 for couch, weighted average price \$5.73 per m². Gross income and variable costs did not only include growing activities but activities of transport and laying as turf is usually supplied on a "laid" basis.

The enterprises used for each agricultural domain is shown in **Table 7**.

Table 7 Current Enterprises per Agricultural Domain within the Project Boundary

Agricultural Domain	Carrying Capacity (DSE/ha)*	Area (ha)	Description of Agricultural Enterprise	Stocking Rate (ha/Breeding Cow or horse)
A		28	Turf farming	
	8	534	Cattle breeding enterprise producing vealers for domestic trade and horse activities	2.0
B	4	826	Cattle breeding enterprise producing vealers for domestic trade and horse activities	4.1
C	1	1,032	Cattle breeding enterprise producing store weaners	27.6
D	-	2,129	No agricultural activity	-

*DSE – Dry Sheep Equivalent. The equivalent daily energy requirement of a 50 kg wether not losing or gaining weight.

The production value of the four agricultural domains per hectare and total value is summarised in **Table 8**.

Table 8 Value of Current Agricultural Production per annum within the Project Boundary

Agricultural Domain	Enterprise	Number Animals Sold*	Gross Value of Production (\$)	Net Value of Production (\$)
A	Turf	186	\$1,275,373	\$858,867
	Vealers		\$117,214	\$66,058
	Horses		\$316,675	\$253,234
B	Vealers	114	\$88,732	\$50,006
	Horses		\$244,975	\$195,898
C	Weaners	29	\$15,263	\$8,629
D	-	-	-	-
Total	Turf	329	\$1,275,373	\$858,867
	Cattle		\$211,209	\$124,693
	Horses		\$561,650	\$449,132
			\$ 2,058,232	\$1,432,692

*Cattle only. includes culled breeding stock.

Table 8 shows that the gross value of agriculture production (including horse related activities) from the Project Boundary, based on the current land use, is \$2, 058,232 per annum. The gross value of future agricultural production amounts to a net present value (NPV) of \$29.4M (at 7% discount rate). The net value of agricultural production is \$1, 432,692 (\$20.5 M present value at 7% discount rate). This is from the sale of 357 head of cattle per annum (weaner and fattened weaners, cull cows and bulls) and approximately 222,578 m² of turf.

It is noted that the Project will not result in all agricultural production being removed from within the Project Boundary. The impacts of the Project on agricultural production are discussed in Section 7 of this report.

The closest regional sale yard with weekly prime sales is at Maitland. Maitland sale yards also hold monthly store cattle sales. The National Livestock Reporting Service NSW Cattle Saleyard Survey for the financial year ended 30 June 2011 (MLA, 2011) shows that the Maitland sale yard had a throughput of 50,800. During this period, the Maitland sale yard was ranked 13th in NSW for cattle sold by auction through the sale yard system. The National Livestock Reporting Service NSW Cattle Saleyard Survey (MLA, 2011) reports a total of 1,847,555 cattle sold through NSW sale yards in 2011.

If it is assumed that all cattle from Project Boundary are sold through the Maitland sale yards, the expected number to be turned off represents 0.65% of Maitland's throughput.

Based on the Maitland sale yard charges of \$5.30 per head (financial year 2012/13), the 357 head sold from the Project Boundary would contribute \$1,892.1 of income to the Maitland sale yards (if all were sold through Maitland). It should be noted that cattle do not necessarily have to be sold through these sale yards but could be sold direct to slaughter works (prime stock) or "out of the paddock" to be grown out and/or fattened by other producers. These options are also popular management choices.

The above figures are an over estimation of the beef production and value and horse enterprises value of the area, and are hence a very conservative assumption. The above are based on gross area calculations and do not account for productive area lost due to farm infrastructure (houses and garden areas, sheds, laneways and access roads, yards, dams and such). Nor are areas discounted for waterways and riparian zones which may or may not be fenced off. Due to the closer settlement pattern within the Project Boundary, these areas would account for a far higher percentage of the agricultural land than would occur in extensively settled agricultural areas such as the Upper Hunter or Central West of NSW.

Blackwood et. al. (2006) states:

"With decreasing property size, the proportion of that farm not suitable for pasture improvement increases also tends to increase significantly along with the per head cost of pasture improvement and herd management (sic). Pasture improvement and maintaining increased productivity may consequently be inappropriate for smaller rural lifestyle properties, especially those with other production constraints (such as poor soils or limited growing seasons)."

This also supports that the above may over estimate the agricultural production from the Project Boundary especially the grazing industries (cattle and horses).

Cattle from the Central Coast are processed outside the region at abattoirs such as Scone NSW, Singleton NSW, Wingham NSW, Casino NSW and Dinmore Queensland. **Table 9** shows the value of the regional, State and National beef slaughtering. It illustrates the relatively small magnitude the agricultural output of Project Boundary compared to regional, State and National production. The LCR comparison is made up of the Wyong, Gosford and Lake Macquarie LGAs.

Table 9 Value of Turf and Beef Slaughtering

Enterprise	Project Boundary [^]	Wyong LGA	LCR	NSW	Australia
Turf	\$1.3 M	\$4.0 M	\$4.4 M	\$58.8 M	\$245.0 M
Beef Slaughtering	\$0.2 M	\$14.9 M	\$74.3 M	\$1,487.6 M	\$6,550.5 M

Source: ABS, 2008; ABS, 2011

[^] Project Boundary includes estimate of horse enterprises which are not included in other areas figures.

Table 9 shows that the estimate value of production from agricultural land within the Project Boundary, which is believed overstates the value of production and includes horse enterprises (which is not included in the comparative figures) is 6.2% of the value of agricultural production from the Wyong LGA, 1.4% of the LCR but only 0.03% of NSW's agricultural production and less than 0.01% of Australia's agricultural production.

5.3.2 Offsite Biodiversity Offset Area

To examine the quantum and value of agricultural production from the Offsite Biodiversity Offset Area the same methodology that was used for the Project Boundary was used with a different enterprise mix for Agricultural Domain B. The agricultural enterprise applied to Domain B was cattle breeding for vealer production (i.e. no horse enterprise).

The production value of the two agricultural domains per hectare and total value is summarised in **Table 10**.

Table 10 Value of Current Agricultural Production per annum from Ecological Offset Area

Agricultural Domain	Enterprise	Number Animals Sold*	Gross Value of Production (\$)	Net Value of Production (\$)
B	Vealers	4	\$2,739	\$1,543
D	-	-	-	-
Total		4	\$ 2,739	\$1,543

*Cattle only. includes culled breeding stock.

Table 10 shows that the gross value of agriculture production from the Ecological Offset Area, based on the current land use is \$2,739 per annum. The gross value of future agricultural production foregone amounts to a net present value (NPV) of \$0.04M (at 7% discount rate). The net value of agricultural production is \$1,543 (\$0.02 M present value at 7% discount rate). This is from the sale of 4 head of cattle per annum (vealers, cull cows and bulls).

5.4 Potential Agricultural Production

5.4.1 Project Boundary

The potential agricultural production of the Project Boundary was examined assuming changes to management to represent superior management and or capital investment. The changes identified included increasing the area of turf production by 150%, pasture improvement and paddock subdivision and stock water reticulation to allow for more intense grazing management of cattle and horses.

The following assumptions were made:

- Domain A:
 - Turf area levelling at \$175/ha followed by standard operational costs for operation: 6.5ML/ha of irrigation water of new turf and irrigation infrastructure assumed in place;
 - \$350 per hectare invested in pasture improvement and repeated every seven years; one off \$125 per hectare for paddock subdivision and stock water reticulation; additional annual pasture maintenance cost of \$50 per ha per annum; carrying capacity improves to 15 DSE/ha;
- Domain B: \$250 per ha invested in pasture improvement and repeated every seven years; one off \$75 per ha for paddock subdivision and stock water reticulation; additional annual pasture maintenance cost of \$50 per ha per annum; carrying capacity improves to 7 DSE per ha;
- Domain C: No change; and
- Domain D: No change.

No allowance has been made for increased risk of seasonal climatic variations and greater sensitivity to timeliness of management decisions and actions. Under the above scenarios the management systems would be operating further along the marginal risk reward portion of the production curve. Also the management required to achieve the pasture intake per hectare would put time pressure on the land managers in this region where most land managers have full time employment off farm.

The expansion of turf production within the Project Boundary assumes market for extra turf production exists within the region.

The extra carrying capacity allocated to horses assumes market demand for the extra horse standing capacity within the local region.

Table 11 shows that the gross value of agricultural production could be increased to \$4,541,810 per annum and the net value to \$3,098,401. This represents an increased gross value of production of \$2,483,578 due to an additional 333,867m² of turf produced, 242 head of cattle sold and horse income increasing by 74%.

Table 11 Maximum Potential of Agricultural Production within the Project Boundary

Agricultural Domain	Enterprise	Number Animals Sold*	Gross Value of Production (\$)	Net Value of Production (\$)
A	Turf	186	\$3,188,432	\$2,147,167
	Vealers		\$202,660	\$114,212
	Horses		\$555,675	\$444,354
B	Vealers	114	\$155,555	\$87,665
	Horses		\$424,225	\$339,238
C	Weaners	29	\$15,263	\$ 8,629
D	-	-	-	-
	Turf	357	\$3,188,432	\$2,147,167
	Cattle		\$373,478	\$210,506
	Horses		\$979,900	\$783,592
Total			\$4,541,810	\$3,141,265

*Cattle would need to be withheld from grazing for first 12 months of pasture improvement.

5.4.2 Offsite Biodiversity Offset Area

The potential agricultural production of the Offsite Biodiversity Offset Area was examined assuming changes to management to represent superior management and or capital investment. The changes identified were, pasture improvement and paddock subdivision and stock water reticulation to allow for more intense grazing management of cattle.

The following assumptions were made:

- Domain B: \$250 per ha invested in pasture improvement and repeated every seven years; one off \$75 per ha for paddock subdivision and stock water reticulation; additional annual pasture maintenance cost of \$50 per ha per annum; carrying capacity improves to 7 DSE per ha; and
- Domain D: No change.

No allowance has been made for increased risk of seasonal climatic variations and greater sensitivity to timeliness of management decisions and actions. Under the above scenarios the management systems would be operating further along the marginal risk reward portion of the production curve. Also the management required to achieve the pasture intake per hectare would put time pressure on the land managers in this region where most land managers have full time employment off farm.

Table 12 shows that the gross value of agricultural production could be increased to \$4,930 per annum and the net value to \$2,778. This represents an increase in gross value of production of \$2,152 due to the sale of an additional 4 head of cattle.

Table 12 Maximum Potential of Agricultural Production from the Offsite Biodiversity Offset Area

Agricultural Domain	Enterprise	Number Animals Sold*	Gross Value of Production (\$)	Net Value of Production (\$)
B	Vealers	8	\$4,930	\$2,778
D	-	-	-	-
Total	Cattle	8	\$4,930	\$2,778

**Cattle would need to be withheld from grazing for first 12 months of pasture improvement.*

5.5 Alternate Agricultural Land Use Suitability

With the large portion of the Project Boundary Zoned 7 Environmental under the Wyong Shire LEP (1991) or State Forest or State Conservation Area, only land within Agricultural Domain A and parts of Agricultural Domain B are zoned Rural 1(a) or Rural 1(C) and therefore able to be developed for agricultural purposes.

Development of this land is limited by the proximity of rural residences on adjoining blocks. This limits the potential for high value, high input agricultural activities such as intensive horticulture including extensive market gardening, control cropping developments and commercial orchards or intensive livestock activities such as dairies, shedded poultry and free range or intensive piggery operations.

Free range poultry operations would be limited by the rural residential nature of the land and the prevalence of domestic dogs as well as wild dog issues from the State Forest and Conservation area. The relatively close settlement within the Project Boundary limits the expansion of commercial agriculture with its trends of high intensification and/or larger holdings to maintain economic viability.

5.6 Stakeholder Consultation

The stakeholder engagement program for the Project and this assessment included consultation with local, state and federal government agencies, neighbouring landowners and industries, and the wider local community. Full details of the stakeholder engagement program for the Project are discussed in the main volume of the EIS.

Consultation specific to the AIS included:

- Hunter Central Rivers CMA; and
- Agriculture NSW.

Hunter Central Rivers CMA raised effect of mine subsidence on creek beds, and acid and potential acid soils.

Agriculture NSW raised mine subsidence on farming infrastructure and location of control cropping developments (glass house and Poly Houses horticulture) of which none was identified in the locality.

6 Risk Assessment

To assist in identifying the key environmental impacts to agricultural resources and enterprises within the locality of the Project, a risk assessment was completed utilising the risk assessment tool, The Risk Matrix. This risk assessment is presented in **Appendix 5**. Each of the potential environmental issues was ranked in accordance with the Risk Matrix as either being of low, medium or significant risk as shown in **Table 13**.

Table 13 Risk Assessment of Project to Agricultural Resources and Enterprises

Category	Issues
High	
Significant	Subsidence
Medium	
Low	Availability and productivity of agricultural land, surface water, ground water, dust, noise, visual, traffic and supporting infrastructure, labour

Following the assessment of potential impacts, risks will be reduced, where reasonable and feasible, or controlled through the implementation of appropriate mitigation and management measures as detailed in Section 9 below.

7 Impact Assessment

This chapter assesses the potential impacts on agricultural land within the Project Boundary and Offsite Biodiversity Offset Area. As part of the AIS, Gillespie Economics was engaged to undertake an economic review of the impacts to existing and potential agricultural resources and enterprises from the Project. A summary of the findings of this review are presented throughout this section and in full in the EIS.

7.1 Availability and Productivity of Agricultural Land

7.1.1 Infrastructure Areas

Both the Tooheys Road Site and the Buttonderry Site, which are owned by the WACJV, currently have limited agricultural activity associated with them. The cleared land for both sites falls within agricultural Domain B. The Disturbance Area at Tooheys Road Site is 79.4 ha and at Buttonderry site is 10.3 ha. Both these areas fall outside the Zone 1 (Rural) land of the Wyong Shire LEP (1991).

As a result of the Project this land will be developed with the appropriate infrastructure resulting in 89.7 ha being removed from non-intensive beef grazing. Based on Section 5, the gross value of agricultural production from this 89.7 ha is \$14,897, while the net value is \$6,466.

Assuming that agricultural production from the entire infrastructure area ceases at the commencement of the Project for perpetuity, the present value of the gross value of production foregone is \$0.21M (using a 7% discount rate) and the present value of the net value of agricultural production foregone is \$0.09M (using a 7% discount rate).

7.1.2 Extraction Area

The Extraction Area shall be subject to mine subsidence (MSEC, 2012). As an example of the extent of the mine subsidence in the agricultural precinct of the Jiliby Creek Valley **Table 14** shows the predicted conventional subsidence on the areas occupied by the turf farm and the horse training establishments.

Table 14 Maximum predicted conventional subsidence, tilt and curvatures for the turf farm and horse training establishments

Location	Maximum predicted conventional subsidence (mm)	Maximum predicted conventional tilt (mm/m)	Maximum predicted conventional hogging curvature (km-1)	Maximum predicted conventional sagging (km-1)
Turf farm	1,1750	11	0.25	0.25
Horse training establishments	1,600	11	0.15	0.25

The nature of the conventional subsidence shall be such that the change in gradient over these areas is expected to be 11mm per 1 m length (1.1%) and as such will be unable to be detected by eye (MSEC 2012). The depth of cover (depth of mining below surface level) and the depth of alluvial soils will lessen the impact of subsidence. This includes the potential effect of “cracking and heaving” of the ground which is predicted to be very minor and isolated if it does occur.

There is a minimum potential that the surface relief of the turf farm may become uneven to the extent that efficient turf cultivation and harvesting bears additional costs (decreased m² harvested per ha cultivated) or is no longer possible (due to mine subsidence) without remediation.

There is a low potential of mine subsidence to affect underground irrigation mains. MSEC (2012) modelling suggests these impacts, if they occur, may result in cracking of individual mains pipes and/or joints. Such breakages would be able to be repaired or mains replaced.

The impact on grazing enterprises (such as beef cattle) is less predictable, less pronounced and has minor economic consequences. Any affect would be due to local run off water from heavy rainfall events (such as summer storms) not draining away resulting in temporary water covering pasture or water-logging from pasture, similar as to what occurs now in lower depressions of the creek flats. Surface and subsurface drainage would help to mitigate these effects if and when they do occur.

Monitoring of surface relief should be carried out during active mining of areas within the Extraction Area.

Notwithstanding WACJV's proposed mitigation and management measures, if the worst case scenario is assumed that turf farming would be lost in the Extraction Area, the loss of the gross value of agricultural production would be \$1,275,373 per annum, while the net value loss is \$858,867 per annum. Based on the proposed mine plan, the area occupied by the turf farm will not be undermined to Year 22 of the Project.

However, the turf production would not be lost in perpetuity after Year 22 as mitigation of the surface (laser levelling) could be undertaken once subsidence settled, any irrigation infrastructure repaired or replaced and the area resown and, production commence again. After subsidence settled, it would be expected that full production would be achieved within 3 growing seasons. The cost of mitigation and temporary foregone net production is estimated \$0.3M (using a 7% discount rate).

7.1.3 Ecological Offsets

As identified in Section 5.3.2 the gross value of agricultural production in the Offsite Biodiversity Offset Area is \$2,739 and the net value is \$1,543. This area will be removed from agricultural production.

Conservatively assuming that agricultural production from the Extraction Area ceases at the commencement of the Project for perpetuity, the present value of the gross value of production foregone is \$0.04 (using a 7% discount rate) and the present value of the net value of agricultural production foregone is \$0.02M (using a 7% discount rate).

7.1.4 Surrounding Locality

The Project will not reduce the availability of land for agricultural purposes or affect the productivity of existing agricultural land outside the Project Boundary. As such, this has not been discussed further in the assessment

7.1.5 Combined Value

The conservative, worst case scenario shows a combined gross value of production from the impacted properties is \$1.3 M. per annum. This includes the full loss of turf production which is not expected to be impacted until Year 22 of the Project. As shown in **Table 15** this value is 3.81% of the total agricultural production of Wyong, 0.02% of NSW and less than 0.01% of Australia.

Table 15 Comparison of Value of Agricultural Production Affected by Project

Category	Project Boundary	Wyong Shire	LCR	NSW	Australia
Turf	\$1,275,373 ¹	\$4.0 M	\$4.4 M	\$58.8 M	\$245.0 M
Beef slaughtering	\$17,636	\$14.9 M	\$74.3 M	\$1,487.6 M	\$6,550.5 M
Total agricultural production	\$1.3 M	\$34.1 M	\$154.7 M	\$8,359.2 M	\$39,645.1 M

Source: ABS, 2008; ABS 2011

In total, foregone net agricultural production from agricultural land resources required for the Project is estimated at \$0.5M present value (using 7% discount rate).

As the overall agricultural contribution of the land to be removed from agriculture from within the Extraction Area, Infrastructure Boundary and Ecological Offset area is small when compared to the total agricultural production on a regional, state and national scale, the reduced availability and productivity of this land will have a minimal impact to the industry.

7.2 Water

7.2.1 Surface water

Predicted changes to conventional tilt, hogging and sagging indicate that surface water flows and runs will not be significantly impacted. However there is the potential for unconventional cracking and heaving which may result in changes to surface water drainage, resulting in overflow water laying in areas and resulting in areas of waterlogging. This may impact on plant growth. Once again the depth of mining and depth of alluvial deposits above the bedrock would indicate that the effect would be minor and isolated.

Monitoring of surface relief will be required during active mining of areas within the Extraction Area.

Overall the surface water impact assessment for the Project has determined that the Project will not impact on downstream water quality (WRM, 2012).

7.2.2 Groundwater

MSEC (2012) has identified there is the possibility of minor and isolated cracking and heaving which may impact on groundwater depth and potential increase the head which ground water will be required to be pumped. If this does occur WACJV will make good any temporary water loss and work with the Mine Subsidence Board to increase bore depths to allow for continued access to groundwater sources.

The EIS groundwater impact assessment provides further details regarding the Project's potential impacts on the existing groundwater regime.

¹ This is a temporary impact for in the order of 2 years from year 22 of the Project.

7.2.3 Movement of water away from agriculture

The Project will not result in any water being physically moved away from agriculture. The EIS surface water impact assessment (WRM, 2012) identified that the maximum external water use required from external sources (town water) is 52ML/a in Year 1, however the total site demand in this year is only 60 ML/annum. The site demand is highest from Year 8 to Year 28 at 250 ML/annum, however due to the groundwater inflows only 20 ML/annum is required to be met by external sources (town water).

7.3 Dust

The impacts of dust on agricultural resources and enterprises in the locality are assessed as minimal as the Project will meet legislative criteria governed for air quality. The implementation of real time monitoring systems within the vicinity of the Project will also ensure that dust emission targets are not exceeded at private receivers.

The predicted dust deposition rates will be nil to minimal impact on the productivity of vegetation due to the Project.

The EIS air quality and greenhouse gas impact assessments address the extent of dust emissions in further detail.

7.4 Noise

The impacts of noise on agricultural resources and enterprises in the locality are assessed as minimal as the Project will satisfy the legislative criteria governing industrial noise at private properties with agricultural value. The implementation of real time monitoring systems within the vicinity of the Project will also ensure that noise targets are not exceeded.

The EIS acoustic impact assessment addresses the extent of noise in further detail).

Given the measures in place to control noise, agricultural resources and enterprises are not anticipated to be impacted by the Project from this aspect. As such, this has not been discussed further in the assessment.

7.5 Visual

The mine infrastructure will be restricted to the Tooheys Road Site and the Buttonderry Site, both of which are remote to the agricultural precinct associated with the Jilliby Jilliby Creek area and therefore will have no visual impact on the agricultural industries within the Project Boundary.

The EIS visual impact assessment describes the Project's impact on the visual aesthetics of the surrounding environment at sensitive receptors in further detail.

7.6 Traffic and Support Infrastructure and Services

Traffic impacts on support infrastructure utilised by agricultural operations in the locality of the Project are minimal as all access to the Project does not pass through the agricultural precincts of the Project Boundary and is therefore not discussed any further in this assessment.

The EIS traffic and transport impact assessment discusses the traffic regime in further detail.

Support services directly employed by agricultural enterprises will not be shared by the Project and therefore will not be impacted.

7.7 Labour Supply

Given the scale of the increase in workforce numbers compared to the local workforce, the part time nature of most of the agricultural businesses and the high unemployment rate in the Wyong LGA, the labour supply available for the operation of agricultural operations is not expected to be impacted as a result of the Project and is therefore not discussed any further in this assessment.

The EIS social impact assessment describes the Project's impact on the broader community in further detail.

8 Mitigation and Management Measures

8.1 Weed and Pest Management

WACJV should develop and implement a weed and pest management plan to control the distribution of invasive species and feral animals on WACJV owned land. This plan will see the commitment of appropriate resources (physical, financial and labour) to ensure it is implemented in an effective manner.

WACJV should consult with the Cumberland Livestock Health and Pest Authority as to the appropriateness of the plan. A monitoring and reporting system will be an integral part of the management plan.

8.2 Subsidence Impacts to Agricultural Enterprises

Any impacts to agricultural enterprises will be managed as part of the Subsidence Management Plan (SMP) process (or equivalent) and in accordance with the Mines Subsidence Compensation Act 1961.

Monitoring of surface relief shall be carried out during active mining of agricultural areas within the Extraction Area. Any “cracking and heaving” which may occur due to irregular movement/subsidence should be mitigated by WACJV. WACJV should undertake remediation measures to reinstate the surface relief of the turf farm and any horse infrastructure area (training areas) affected by subsidence resulting from the Project.

Should cracking of individual irrigation pipes and / or joints be attributed to the Project, WACJV should be responsible for fixing or replacing the broken item. It is noted that there is potential that these mains are asbestos mains, and as such necessary health and safety precautions when accessing, repairing and disposing of asbestos mains would need to be in place.

9 Conclusion

The Project is located in an area primarily used for rural residential and small scale sub commercial agricultural activities. A notable exception is a turf farm located within the Extraction Area. Other agricultural activities carried out within the Extraction Area and Infrastructure Boundary are small scale non-intensively managed beef cattle grazing. Horse activities, commercial and recreational, also occupy agricultural land within the extraction area.

A conservative approach (maximum value) valuing the agricultural production from the Project area identified that the gross value of agricultural production of the Project area was \$2.1 M per year being:

- \$1.3 M from turf farming;
- \$0.2 M from beef production; and
- \$0.6M from horse activities.

The area that will be removed from agricultural production (Disturbance Area) is 89.7 ha and is used for low intensity managed beef grazing. The gross value of agricultural production from this area is \$14, 897 per annum.

The Offsite Ecological Offset property adjacent to the Buttonderry Site has an area of 21 ha used for non-intensively managed beef grazing. The gross value of agricultural production from this area is \$2,739 per annum.

It was identified that the subsidence is a potential temporary risk to the turf farm operation within the Extraction Area. It is noted that WACJV will undertake mitigation and remediation activities to minimise the impact on the turf farm operation. Notwithstanding this, in a worst case scenario the loss of turf production has a gross value of \$1,275,373 per annum and would occur for approximately two years from Year 22 of the Project.

The value of agricultural production from the combined area lost to agriculture (the Disturbance Area, Offsite Ecological Offset Area and turf farm) in the worst case scenario is predicted to be \$1.3 M. This represents 0.84% of the gross value of agricultural production in the local coastal region (Gosford, Wyong and Lake Macquarie LGAs), 0.016% of NSW's agricultural production and 0.003% of the national production. If the value of production from the turf farm is not lost, the lost agricultural production is \$17,636 per annum. This lost \$17,636 of agricultural production is from the Project Infrastructure areas and the Offsite Offset area.

The Project does not reduce the permanent area available to agriculture as any impact on the turf farm would only be temporary.

As the overall agricultural contribution of the Disturbance Area within Project Boundary and the Offsite Ecological Offset Area is small when compared to the total agricultural production on a regional, state and national scale, the reduced availability and productivity of this land will have a minimal impact to the industry. In addition, the Project will not reduce the availability of land for agricultural purposes or affect the productivity of existing agricultural land outside the Project Boundary.

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Appendices

Appendix 1	Assumptions for carrying capacity of Project Area (Existing)
Appendix 2	Assumptions for carrying capacity of Ecological Offset Area (Existing)
Appendix 3	Assumptions for carrying capacity of Project Area (Full Potential)
Appendix 4	Assumptions for carrying capacity of Ecological Offset Area (Full Potential)
Appendix 5	Risk Assessment

Appendix 1 Assumptions for carrying capacity of Project Area (As Is)

Ag Domain		A			B		C	D	Total
Wallarrah	Ha	572			826		1,032	2,129	4,559
	%	12.5			18.1		22.6	46.7	
	Grazing area used	Beef 80%	Horses 20%	Turf	Beef 80%	Horses 20%	Beef 100%	100%	
	Ha	435	109	28	661	165	1,032	2,129	4,559
	%	9.5	2.4	0.6	14.5	3.6	22.6	46.7	
CURRENT	DSE/ha	8	8		4	4	0.5	0	
	TDM/ha	2.92	2.92		1.46	1.46	0.1825	0	
Total DSE		3,482	870		2,643	661	516	0	8,172
Total pasture		1,271	318		965	241	188	0	2,983
Enterprise		Vealer			Vealer		Weaner	-	
DSE Rating	DSE/breeding cow	16.27			16.27		13.82	0	
Total cows/horses		214	53		162	41	37	-	507
Stocking rate	ha/breeder	2.0	2.1		4.1	4.0	27.6	-	
Gross Income	\$/ha	\$ 269.33		\$45,549.03	\$ 134.28		\$ 14.79	-	
Costs	\$/ha	\$ 117.55		\$14,875.21	\$ 58.60		\$ 6.43	-	
Gross Margin	\$/ha	\$ 151.79		\$30,673.82	\$ 75.68		\$ 8.36	-	
Animals sold per ha		0.4			0.2		0.0	-	
Gross Income	\$/breeder	\$ 547.73	\$5,975.00		\$ 547.73	\$ 5,975.00	\$ 412.50	-	
Costs	\$/breeder	\$ 239.05	\$1,197.00		\$ 239.05	\$ 1,197.00	\$ 179.28	-	
Gross Margin	\$/breeder	\$ 308.68	\$4,778.00		\$ 308.68	\$ 4,778.00	\$ 233.22	-	
Animals sold per 100 breeders		89			84		84	-	
Gross Income	\$	\$ 117,214	\$ 316,675	\$1,275,373	\$ 88,732	\$ 244,975	\$ 15,263	-	\$2,058,232
Costs	\$	\$ 51,157	\$ 63,441	\$ 416,506	\$ 38,726	\$ 49,077	\$ 6,633	-	\$ 625,540
Gross Margin	\$	\$ 66,058	\$ 253,234	\$ 858,867	\$ 50,006	\$ 195,898	\$ 8,629	-	\$1,432,692
Total Animal Sold		190			136		31	-	357

Horse enterprise per horse

Dry mare	Days per year	265
	\$/day	\$15.00
Wet mare	Days per year	100
	\$/day	\$20.00
Ave across year	\$/day	\$16.37
Full Feed costs per day		
Supplement	\$/kg	\$0.70
Hay	\$/tonne	\$350
Hay wastage	20%	
Full feeding	days	100
Supp fed	Kg	4
Hay fed	kg	4
Costs fed per day		\$3.28
Animal Health		
Pasture costs per ha/yr	\$	80.00
Animal health costs/yr	\$	675.00
Margin over input costs/day		\$11.02

	Turf	Beef	Horses	Total
Gross Value	\$1,275,373	\$ 221,209	\$ 561,650	\$2,058,232
Variable Costs	\$ 416,506	\$ 96,516	\$ 112,518	\$ 625,540
Net Income	\$ 858,867	\$ 124,693	\$ 449,132	\$1,432,692

Assumptions for carrying capacity of Ecological offsets area (As Is)

Appendix 2

Ag Domain Wallarah	Ha %	B 21 31.8%	D 45 68.2%	Total 66
	Grazing area used Ha %	Beef 100% 21 100.0	100% 45 100.0	66
CURRENT	DSE/ha TDM/ha	4 1.46	0 0	
Total DSE		84	0	84
Total pasture Enterprise		31 Vealer	0 -	31
DSE Rating	DSE/breeding cow	16.27	0	
Total cows		5	-	5
Stocking rate	ha/breeder	4.1	-	
Gross Income	\$/ha	\$ 130.41	-	
Costs	\$/ha	\$ 56.92	-	
Gross Margin	\$/ha	\$ 73.50	-	
Animals sold per ha		0.2	-	
Gross Income	\$/breeder	\$ 547.73	-	
Costs	\$/breeder	\$ 239.05	-	
Gross Margin	\$/breeder	\$ 308.68	-	
Animals sold per 100 breeders		84	-	
Gross Income	\$	\$ 2,739	-	\$ 2,739
Costs	\$	\$ 1,195	-	\$ 1,195
Gross Margin	\$	\$ 1,543	-	\$ 1,543
Total Animal Sold		4	-	4

Appendix 3 Assumptions for carrying capacity of Project Area (Full Potential)

Ag Domain		A			B		C	D	Total
Wallarrah	Ha	572			826		1,032	2,129	4,559
	%	12.5			18.1		22.6	46.7	
	Grazing area used	Beef	Horses	Turf	Beef	Horses	Beef	100%	
	Ha	80%	20%		80%	20%	100%		
	%	402	100	70	661	165	1,032	2,129	4,559
		8.8	2.2	1.5	14.5	3.6	22.6	46.7	
CURRENT	DSE/ha	15	15		7	7	0.5	0	
	TDM/ha	5.475	5.475		2.555	2.555	0.1825	0	
Total DSE		6,024	1,506		4,626	1,156	516	0	13,828
Total pasture		2,199	550		1,688	422	188	0	5,047
Enterprise		Vealer			Vealer		Weaner	-	
DSE Rating	DSE/breeding cow	16.27			16.27		13.82	0	
Total cows/horses		370	93		284	71	37	-	855
Stocking rate	ha/breeder	1.1	1.1		2.3	2.3	27.6	-	
Gross Income	\$/ha	\$ 504.63		\$45,549.03	\$ 235.40		\$ 14.79	-	
Costs	\$/ha	\$ 220.24		\$14,875.21	\$ 102.74		\$ 6.43	-	
Gross Margin	\$/ha	\$ 284.39		\$30,673.82	\$ 132.67		\$ 8.36	-	
Animals sold per ha		0.8			0.4		0.0	-	
Gross Income	\$/breeder	\$ 547.73	\$ 5,975.00		\$ 547.73	\$ 5,975.00	\$ 412.50	-	
Costs	\$/breeder	\$ 239.05	\$ 1,197.00		\$ 239.05	\$ 1,197.00	\$ 179.28	-	
Gross Margin	\$/breeder	\$ 308.68	\$ 4,778.00		\$ 308.68	\$ 4,778.00	\$ 233.22	-	
Animals sold per 100 breeders		89			84		84	-	
Gross Income	\$	\$ 202,660	\$ 555,675	\$3,188,432	\$ 155,555	\$ 424,225	\$ 15,263	-	\$4,541,810
Costs	\$	\$ 88,449	\$ 111,321	\$1,041,265	\$ 67,890	\$ 84,987	\$ 6,633	-	\$1,400,545
Gross Margin	\$	\$ 114,212	\$ 444,354	\$2,147,167	\$ 87,665	\$ 339,238	\$ 8,629	-	\$3,141,265
Total Animal Sold		329			239		31	-	599

Horse enterprise perhorse

Dry mare	Days per year	265
	\$/day	\$15.00
Wet mare	Dayes per year	100
	\$/day	\$20.00
Ave across yei	\$/day	\$16.37
Full Feed costs per day		
Supplement	\$/kg	\$0.70
Hay	\$/tonne	\$350
Hay wastage	20%	
Full feeding	days	100
Supp fed	Kg	4
Hay fed	kg	4
Costs fed per day		\$3.28
Pasture costs per ha/yr	\$	80.00
Animal health Costs	\$	675.00
Margin over input costs/day		\$11.02

	Turf	Beef	Horses	Total
Gross Value	\$3,188,432	\$ 373,478	\$ 979,900	\$4,541,810
Variable Costs	\$1,041,265	\$ 162,972	\$ 196,308	\$1,400,545
Net Income	\$2,147,167	\$ 210,506	\$ 783,592	\$3,141,265

Assumptions for carrying capacity of Ecological offset area (Full Potential)

Appendix 4

Ag Domain Wallarah	Ha %	B 21 31.8%	D 45 68.2%	Total 66
	Grazing area used Ha %	Beef 100% 21 100.0	100% 45 100.0	66
CURRENT	DSE/ha TDM/ha	7 2.555	0 0	
Total DSE		147	0	147
Total pasture Enterprise		54 Vealer	0 -	54
DSE Rating	DSE/breeding cow	16.27	0	
Total cows		9	-	9
Stocking rate	ha/breeder	2.3	-	
Gross Income	\$/ha	\$ 234.74	-	
Costs	\$/ha	\$ 102.45	-	
Gross Margin	\$/ha	\$ 132.29	-	
Animals sold per ha		0.4	-	
Gross Income	\$/breeder	\$ 547.73	-	
Costs	\$/breeder	\$ 239.05	-	
Gross Margin	\$/breeder	\$ 308.68	-	
Animals sold per 100 breeders		84	-	
Gross Income	\$	\$ 4,930	-	\$ 4,930
Costs	\$	\$ 2,151	-	\$ 2,151
Gross Margin	\$	\$ 2,778	-	\$ 2,778
Total Animal Sold		8	-	8

Appendix 5 Risk Assessment Template

Risk Identification

Identify the types of risk that could arise from the activity, such as:

	Availability and productivity of agricultural land
	Subsidence
	Water
	Dust
	Noise
	Visual
	Traffic and supporting infrastructure
	Labour

Risk Quantification

Risks are quantified in terms of likelihood and possible consequences.

Qualitative measures of likelihood

Level	Descriptor	Example detail description
1	Rare	May occur only in exceptional circumstances
2	Unlikely	Could occur at some time
3	Possible	Might occur at some time
4	Likely	Will probably occur in most circumstances
5	Almost certain	Is expected to occur in most circumstances

*Qualitative measures of consequence/ impact**

Level	Descriptor	Example detail description
1	Insignificant	Minimal change in land use or agricultural resources; low financial loss
2	Minor	Low change in land use or agricultural resources within Project Area or minimal change in locality; low financial loss
3	Moderate	Medium change in land use or agricultural resources within Project area or low change in locality; medium financial loss
4	Major	Significant changes in land use or agricultural resources within Project Area or locality; high financial loss
5	Catastrophic	Major change in land use or agricultural resources within Project Area and locality; huge financial loss

*Qualitative risk analysis matrix – level of risk**

<i>Likelihood</i>	<i>Consequences</i>				
	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
1 (Rare)	Low	Low	Medium	High	High
2 (Unlikely)	Low	Low	Medium	High	Significant
3 (Moderate)	Low	Medium	High	Significant	Significant
4 (Likely)	Medium	High	High	Significant	Significant
5 (Almost certain)	High	High	Significant	Significant	Significant

Risk Quantification (1= low, 5= extreme)

Risk type	Description	Likelihood	Consequences	Overall rating
Availability and productivity of agricultural land	Project will result in large areas of productive land being removed from agriculture	2	1	Low
Subsidence	Subsidence affects surface relief affecting productivity of turf farming	5	2	High
	Subsidence affects surface relief affecting evenness of horse training and facilities	5	1	High
	Subsidence effects damage underground irrigation mains (probably asbestos mains)	5	2	High
	Subsidence affects on irrigation water availability	4	3	High
	Subsidence affects watertable and drainage increasing occurrence of water logging and or surface water accumulation	4	3	Low
	Subsidence causes groundwater drainage exposing Acid Sulfate Soils and Potential Acid Sulfate Soils to oxygen, releasing sulphuric acid into soil and waterways	2	3	Med
Surface and ground water	Project affects downstream water quality	1	2	Low
	Project affects groundwater availability (depth) increasing cost of stock and irrigation water pumping	2	3	Med
Dust	Dust from Project will affect plant growth and or quality or impact on animal performance	1	1	Low
Noise	Noise levels have adverse impacts on animal behaviour and production	1	1	Low
Visual	Visual impact on mine affects the marketability of agricultural production or enterprises in locality	1	1	Low
Traffic and supporting infrastructure	Change in traffic and support infrastructure impacts on efficiency of agricultural operations	1	1	Low
Labour	Removed labour resources from agriculture	1	1	Low